Built to withstand a Shuttle Launch...

HALT Based Design Process

(Highly Accelerated Life Test)

The Ultimate Test for Reliability

The HALT test was initially conceived for testing electronic products for shuttle launch. The purpose of this test is to subject the product to a combination of high shock, vibration, and a steep temperature gradient. MTBF of all electronic products depends upon the strength of connections of various components inside and therefore HALT is the ultimate test for reliability testing. Here is how it works:

1. Initial Design Specifications

Before a product is taken to the drawing board, all the desired specifications are laid out around which a product is to be designed. These specifications are based on the actual working parameters that are applied to our products in the industry. Let's pick an example of our Toughpanel and see all the steps it goes through. The published specifications for Toughpanels are to the right:

2. HALT Test Of Finished Product

Once a product is designed and built as per initial specifications, it is subjected to HALT testing. Again the point of this phase is to eliminate any pre-mature failure that might be present in its initial design. Based on the above published specifications, Toughpanel is subjected to the following tests:

I) Without Power (Non-Operating)

A - Temperature Cycling: 20°C beyond published spec @ 100°C/min.

For Non-Operating (storage) conditions, Toughpanel goes through a total of 50 cycles of thermal shock in the range of -40˚C to +80˚C at the rate of 100˚C/min. If Toughpanel passes Temperature Cycling testing, it advances to the next step. If for any reason Toughpanel doesn't complete temperature cycling testing for at least 50 cycles it goes back to the drawing board for a re-design and the process continues until it passes.

B - Shock and Vibration Cycling: 2 Times published spec

After Toughpanel passes Temperature Cycling testing, it is subjected to Vibration and Shock testing as set by internal HALT specifications of 5-55 HZ 4 G's for 2 hours maximum and 20 G's for 12 ms respectively Non-Operating (storage) conditions. If Toughpanel passes the Shock and Vibration cycling tests, it advances to the next step. If for any reason Toughpanel does not complete the Shock and Vibration cycling tests for at least 50 cycles, it goes back to the drawing board for a re-design and the process continues until it passes.

C - Combined Temperature and Shock/Vibration: 20°C beyond & 2 Times Gs @ 100°C/min.

After Toughpanel passes Shock and Vibration cycling tests, it is subjected to a combined Temperature, Shock, and Vibration test as set by internal HALT specifications of -40˚C to +80˚C at the rate of 100˚C/min, 5-55 HZ 4 G's for 2 hours maximum, and 20 G's for 12 ms respectively for Non-Operating (storage) conditions.

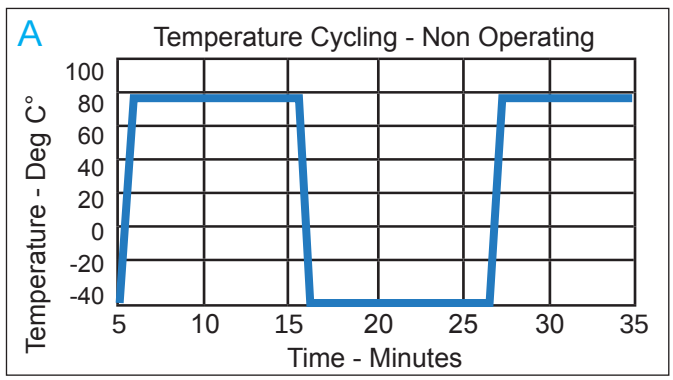
Toughpanel's Published Specifications:

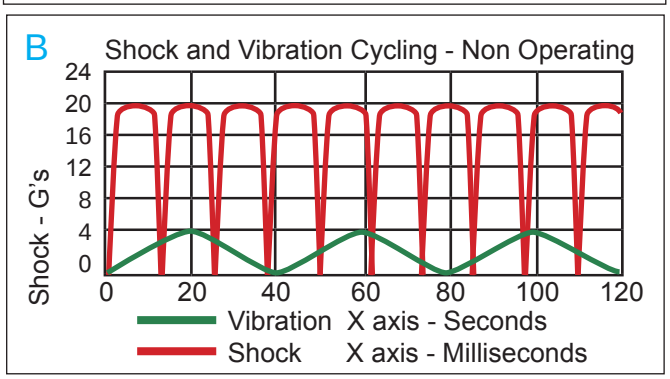
Storage (Non-Operating) Temperature: -30˚C to +70˚C
Operating Temperature: -20˚C to +60˚C
Vibration: 5 to 55 Hz 2 G's for 2 hours in X, Y, and Z axis
Shock: 10 G for 12ms in the X, Y, and Z axis

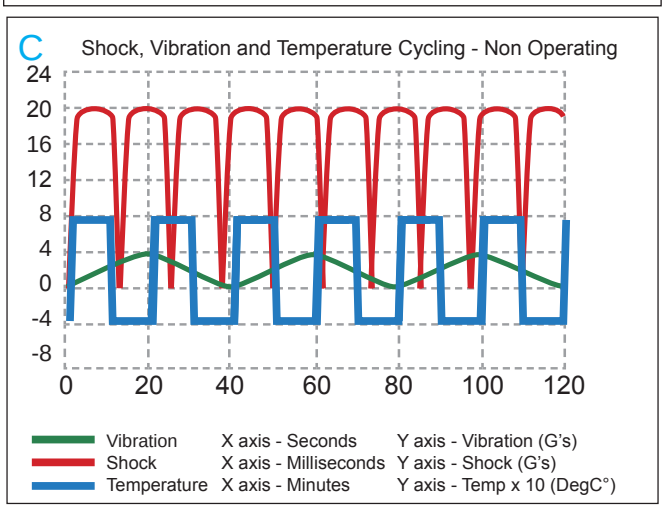
Internal HALT Threshold To Achieve The Above Published Specifications:

Our internal HALT thresholds are ALWAYS higher then the required published specifications. These thresholds for Toughpanel are as follows:

Storage Temperature: -40˚C to +80˚C
Storage (Non-Operating) Vibration: 5 to 55 Hz 4 G's for 2 hours in X, Y, and Z axis
Storage (Non-Operating) Shock: 20G for 12ms in the X, Y, and Z axis
Operating Temperature: -20˚C to +60˚C
Operating Vibration: 5 to 55 Hz 2.4 G's for 2 hours in X, Y, and Z axis
Operating Shock 10G for less than 12ms in the X, Y, and Z axis







II) Unit Under Power, Fully Functional (Operating)

A - Temperature Cycling: 10°C beyond published spec @ 100°C/min.

For Operating conditions, Toughpanel goes through a total of 50 cycles of thermal shock in the range of -30˚C to +70˚C at the rate of 100˚C/min. If Toughpanel passes Temperature Cycling testing, it advances to the next step. If for any reason Toughpanel does not complete temperature cycling tests for at least 50 cycles it goes back to the drawing board for a re-design and the process continues until it passes.

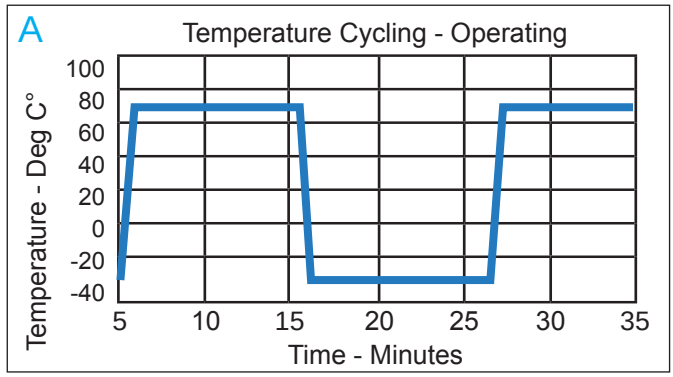
B - Shock and Vibration Cycling: 20% beyond published spec

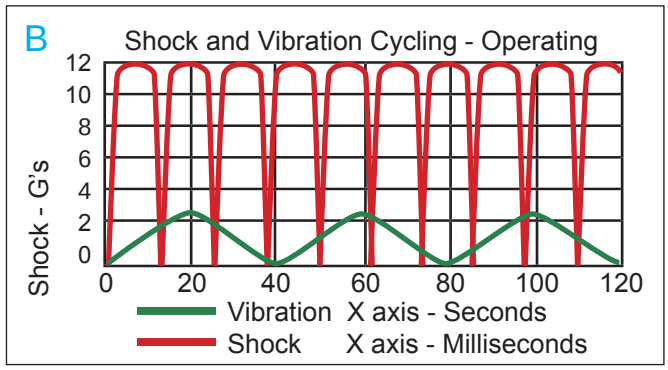
After Toughpanel passes Temperature Cycling testing, it is subjected to Vibration and Shock tests as set by internal HALT specifications of 5-55 HZ 2.4 G's for 2 hours maximum and 12 G's for 12 ms respectively Operating conditions. If Toughpanel passes the Shock and Vibration cycling tests, it advances to the next step. If for any reason Toughpanel does not complete the Shock and Vibration cycling tests for at least 50 cycles, it goes back to the drawing board for a re-design and the process continues until it passes.

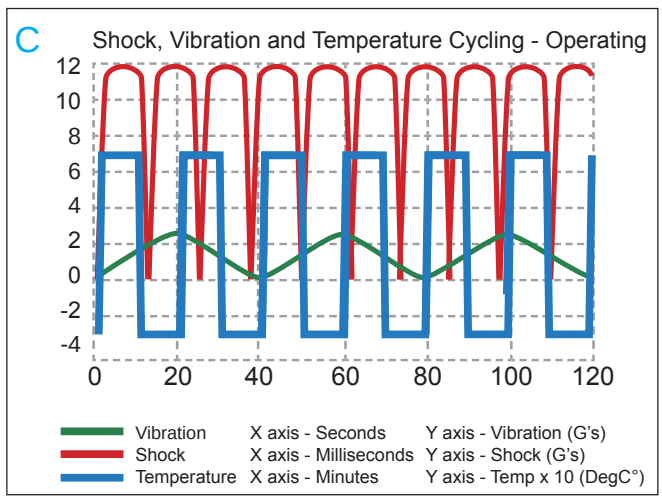
C - Combined Temperature and Shock/Vibration: 10°C beyond & 20% beyond published Gs @ 100°C/min.

After Toughpanel passes Shock and Vibration cycling testing, it is subjected to a combined Temperature, Shock, and Vibration test as set by internal HALT specifications of -30˚C to +70˚C at the rate of 100˚C/min, 5-55 HZ 2.4 G's for 2 hours maximum, and 12 G's for 12 ms respectively for Operating conditions.

After the successful completion of both Operating and Non-Operating HALT tests within specifications, Toughpanel is released for production.







HASS Based Manufacturing Process

Highly Accelerated Stress Screening (HASS)

HASS is an integral part of the manufacturing process at AVG/Uticor. The main purpose of HASS testing is to ensure that our manufacturing processes are in control. 1% AQL (per Mil Spec) level samples from the end of the manufacturing line are subjected to HASS testing to qualify and re-qualify the manufacturing process. If we detect a failure in HASS testing beyond acceptable Mil Spec numbers, the entire manufacturing lot is segregated for further screening. To explain this further, lets continue with the example of Toughpanel.

The operating specification for Toughpanel is -20˚C to +60˚C with 2Gs of vibration and 10Gs of shock. 1% AQL sample of a production run will be subjected to HASS testing from -30˚C to +70˚C @ 2.2 Gs of vibration and 11 Gs of shock. Failure beyond Mil Spec number based on 1% AQL, will subject the entire lot to segregation and further analysis.

HALT/HASS Chamber

-60˚C to 150˚C at 100˚C/min @ 50 Gs of shock and vibration. We invested over $500,000 in this HALT/HASS Chamber.